

REMARKS

This amendment is in response to the final Office action of July 23, 2008 (Office action). Applicants amend claims 11, 14, and 25 to present these claims in better condition for appeal. Claim 14 is amended to add a semicolon at line 10. Claims 1-29 and 34 are pending. Applicants request reexamination and reconsideration of the application.

In sections 1-2 of the Office action, the examiner rejects claims 11 and 25 under 35 USC 112, second paragraph, as indefinite. The examiner states two surface mount components cannot be connected to the conductive pads.

Applicants delete the "second" surface mount component: "a surface mount component electrically connected to the conductive pad" in claims 11 and 25.

In sections 3-4 of the Office action, the Examiner rejects claims 1-29 and 34 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,811,736 to Lauffer et al. (Lauffer) and U.S. Patent No. 6,630,631 to Dishongh et al. (Dishongh).

Before we discuss the new rejection, we should discuss the solder wicking problem that our invention addresses.

As illustrated in our Figure 1, when a conductive pad 32 is in close proximity to a via hole 38, the solder mask 34 won't prevent solder wicking into via hole 38. This is a matter of the gravity, the surface tension and the capillary action that the solder experiences. Even if some solder wicking into the via hole can be tolerated, the remaining solder will too often be insufficient to form a reliable solder joint 31 at the surface mount component 33.

In contrast, Lauffer teaches use of solder wicking to achieve its goal. As stated in Lauffer: "the solder is reflowed (i.e. heated) and thereby flows by gravity and surface tension well into hole 41, onto surface land 18, against surface land 38, by capillary action into the gap 51 between surface lands 18 and 38 and against

1 lead 44 as illustrated" (See Lauffer's Figures 1-3 and col. 3, lines 40-65). Solder
2 wicking is required to produce "the final solder arrangement" in Lauffer (See
3 solder 55 in Lauffer's Figures 3, 6, 9, and 12).

4 As examiner admits, Lauffer has no plated via connected to a conductive trace
5 (See Office action page 3). Instead, Lauffer's hole 41 is under the surface mount
6 component, and hence, no need for a conductive trace. And the solder 55 fills the
7 hole 41 by solder wicking (See Lauffer's Figures 3, 6, and 9). Thus, Lauffer
8 describes solder-filled blind-vias at the terminal end of a surface mount
9 component, which is the opposite of what is required in claim 1.

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11 As examiner also admits, Lauffer fails to describe a solder mask that surrounds a
12 plated via (See Office action page 3). And Lauffer's solder mask 53 fails to reduce
13 solder formation at the terminal end of a surface mount component as recited in
14 claim 1 (See Lauffer's Figures 3, 6, 9, and 12).

15 Dishongh fails to counter Lauffer's teaching away. Instead, Dishongh's BGA
16 package connects to the PCB through solder balls placed above vias, which
17 promote solder wicking. And Dishongh's via plugs prove solder wicking exists
18 (See Dishongh's Figure 1-2, col. 1, lines 13-30 and col. 2, line 51 through col. 3,
19 line 25).

20 The examiner's rationale for combining Dishongh and Lauffer fails to present "a
21 convincing line of reasoning supporting the rejection." Instead, examiner alleges
22 it would be obvious to use Dishongh's teaching in Lauffer "to protect solder splash
23 and prevent short circuit when the component connected to the substrate by
24 solder" (See Office action pages 3-4). This rationale is unclear and insufficient to
25 support combining Lauffer and Dishongh.

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27 Yet in *KSR International Co. v. Teleflex Inc.* 126 S.Ct. 1837 (2006) the U.S.
28 Supreme Court required examiners state "some articulated reasoning with some
29 rational underpinning to support the legal conclusion of obviousness." The
30 Supreme Court left undisturbed the requirement that an examiner must present a
"convincing line of reasoning supporting a rejection." MPEP 2144.

1 In view of the above, the rejection of claim 1 involves clear legal and factual error
2 given (1) Lauffer and Dishongh both teach away from claim 1, and (2) the
3 rationale for combining Lauffer and Dishongh fails to present a convincing line of
4 reasoning supporting the rejection.

5 We understand that claim 1 should be interpreted broadly and consistent with
6 Figures 4A and paragraph [0021] as set forth in *In re Morris*, 127 F.3d 1048, 1054,
7 44 USPQ 2d 1023, 1027 (Fed. Cir. 1997) so we now turn to the specification and
8 drawings.

9
10 Figure 4A illustrates the solder mask 54 exposes a part of the conductive pad
11 (e.g., the arms 98, 97) that extend beyond terminal sides 75, 76 of the component
12 53 to facilitate solder formation (e.g., solder joints 41, 51) between the conductive
13 pad and the terminal sides 75, 76. The solder mask 50 prevents solder formation
14 at the terminal end to reduce solder formation at the first plated via 55.

15 Amended claim 1 captures these differences in requiring a substrate with a via
16 and pad structure connecting a surface mount component to conductive layers of
17 the substrate, comprising:

18 a surface mount component, wherein the surface mount component
19 includes a package having an upper surface with solderable terminal sides and a
20 terminal end;

21 a substrate;

22 a plated via connected to the conductive layers;

23 a solder mask surrounding the plated via; and

24 a conductive pad with a conductive trace connected to the plated via,
25 wherein the solder mask exposes a part of the conductive pad that extends
26 beyond the solderable terminal sides of the surface mount component to
27 increase solder formation between the conductive pad and the solderable
28 terminal sides and to reduce solder formation at the first plated via.

29 In view of the above, claim 1 and its dependent claims are patentable over Lauffer
30 and Dishongh.

1 Dependent claim 2 is separately patentable, because it further requires that the
2 solder mask covers a part of the conductive pad that extends beyond the
3 solderable terminal end and reduces solder formation at the terminal end of the
4 surface mount component. Lauffer and Dishongh clearly fail to teach or suggest
5 claim 2.

6 Dependent claims 3-13 and 29 are separately patentable because each claim
7 further requires, among other limitations, the limitations of claim 2.

8 Claim 14 captures at least the differences mentioned above in requiring a
9 substrate with a plurality of via and pad structures connecting a surface mount
10 component to conductive layers of the substrate, comprising:

11 a surface mount component, wherein the surface mount component
12 includes a package having an upper surface with first solderable terminal sides
13 and a first terminal end and second solderable terminal sides and a second
14 terminal end;

15 a substrate;

16 a first plated via connected to the conductive layers;

17 a first solder mask surrounding the first plated via;

18 a second plated via connected to an associated conductive layer;

19 a second solder mask surrounding the second plated via;

20 a first conductive pad with a conductive trace connected to the first plated
21 via, wherein the first conductive pad includes a portion that is exposed to solder
22 and extends beyond the first solderable terminal sides of the surface mount
23 component to increase solder formation along the first solderable terminal sides
24 and to reduce solder formation at the first plated via; and

25 a second conductive pad with a conductive trace connected to the second
26 plated via, wherein the second conductive pad includes a portion that is exposed
27 to solder and extends beyond the second solderable terminal sides of the surface
28 mount component to increase solder formation along the second solderable
29 terminal sides and to reduce solder formation at the second plated via.

1 In view of the above, claim 14 and its dependent claims 15-28 and 34 are
2 patentable over Lauffer and Dishongh, for at least the reasons presented in
3 connection with claim 1.

4 In addition, dependent claims 15-28 are separately patentable because each claim
5 further requires, among other limitations, that the first solder mask covers and
6 reduces solder formation at the first terminal end of the surface mount
7 component and the second solder mask covers and reduces solder formation at
8 the second terminal end of the surface mount component.

9 Please call if you have any question or comment regarding this amendment.

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11 Respectfully Submitted,

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